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AN IMPERFECT LICHEN FOUND IN THE ANTARCTICA

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SIRAHAMA, WAKAYAMA-KEN
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IN April, 1960, the writer had a good chance to observe the fresh materials of several lower plants collected in Ongul Islands and their neighbouring Antarctic region by Mr. Sadanori MURAUCHI during the Japanese Antarctic Research Expedition in 1959-'60. Among them, an interesting plant, which looks like the white powdery masses, drew the writer's attention.

This is developing as irregular patches, co-existing with the blue alga "*Gloeocapsa* sp." upon the polster-like mass of *Bryum antarcticum* Hook. f.



Fig. 1. Plant life on the sandy ground of East Ongul Island (Phot. by H. Fukushima, Feb. 2, 1959). White particles of imperfect lichen are shown on polster-like *Bryum antarcticum*, co-existing with *Gloeocapsa* sp.

et WILS., which is commonly found on the low and moist sandy grounds all over the region. Later, it was found that Mr. H. FUKUSHIMA had also collected this lower plant and photographed its habitat (Fig. 1).

General appearance. Externally, this seems to be composed of sterile hyphae which give the white and powdery appearance because of the fact that

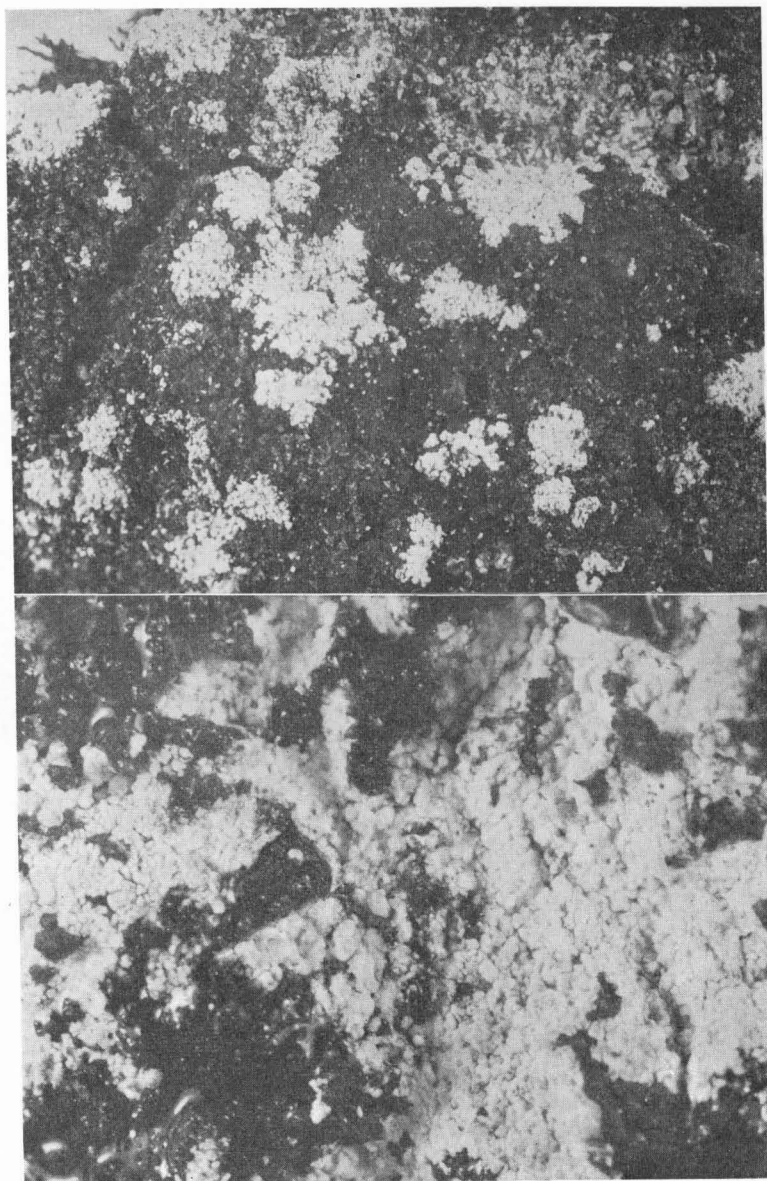


Fig. 2. Surface view of imperfect lichen growing on *Bryum antarcticum*. Upper $\times 3$, lower $\times 10$.

An imperfect lichen found in the Antarctica

they are separated in a form of gemmae and aggregate loosely, leaving the spaces among them. Surrounded with these hyphae, unicellular green algae are grouping together especially at the lower part of the plant. Frequently, this plant develops directly on the surface of the polster-like mass of the above mentioned moss. It seems that the said plant is offered only the suitable warm and moist substrata by these alga and moss, without having any benefit in nourishment. Fungal component does not form the special peridial layer, but expands along the undulating surface of substrata as thin mycelial tomentose mat, which is orbicular, lobed or irregularly elongated and sometimes touches to neighbouring one, attaining 2–15 mm in diameter. Included in these tomentose mat are formed of many soredia which are sphaeroid, 0.1–0.4 mm in diameter, upper surface of them being pure white, lower pale green, internally stuffed with algal cells mingled with fungal gemmae. Some algal cells are also seen outside of soredia without touching directly to hyphae.

Algal component. Cells sphaeroid or subsphaeroid, rarely ovoid, uniformly thin-walled, various in size, $5\text{--}15\mu$ in diameter; chromatophores extending nearly to the cell wall, stellate, irregularly lobed or at times with an eclipse at one side, with a large pyrenoid at center; a nucleus lying on one side of chloroplast and next to cell wall; chromatophore divided frequently into many ellipsoidal or subsphaerical small bodies which look like the initial cells of zoospores; autospores produced 10–20 in each cell, their shape and contents being same with those of mother cell, enclosed with mother cell membrane for a long time after maturity. The above mentioned characteristics agree with those of the genus *Trebouxia* DE PUYMALY (Chlorococcaceae). Although the zoospores of this plant are not yet observed, the writer gives it provisionally a name "*Trebouxia antarctica* Y. KOBAYASI". This algal genus has been known as the gonidia of many genera of lichen such as *Xanthoria*, *Cladonia*, *Parmelia* and *Usnea*. It is supposed that this alga may also be surviving alone irrespective of fungal hyphae in this territory.

Fungal component. Hyphae $2\text{--}4\mu$ in thickness, hyaline, tortuous, multi-septate, easily liberated at each septum, forming gemmae; gemmae ellipsoidal, bone-shaped or like W, T, U figures, hyaline or pale purplish, thin-walled, vacuolate; some hyphae entangled with algal cells by their lateral side, without forming haustoria; blastospores rarely produced, germinated apically or laterally from hyphae or gemmae, commonly single, ovoid, hyaline, $2\text{--}3\mu$ long, budding of them uncertain; hyphae produced from soredia, which were kept in the moist chamber in refrigerator, tomentose, 2μ in thickness, hyaline, branched, septate without clamp connection. Considering from the formation of blastospore as well as the normal septate hyphae, this seems to be near the members of *Trichosporon* belonging to the Moniliaceae of imperfect fungi.

Associative effects between algal and fungal components. The writer tried the hanging drop culture to research the germination of gemmae of fungus and aplanospores of alga by setting the one of soredia on cover-glass and breaking up the components with pressure. After one week's preservation in

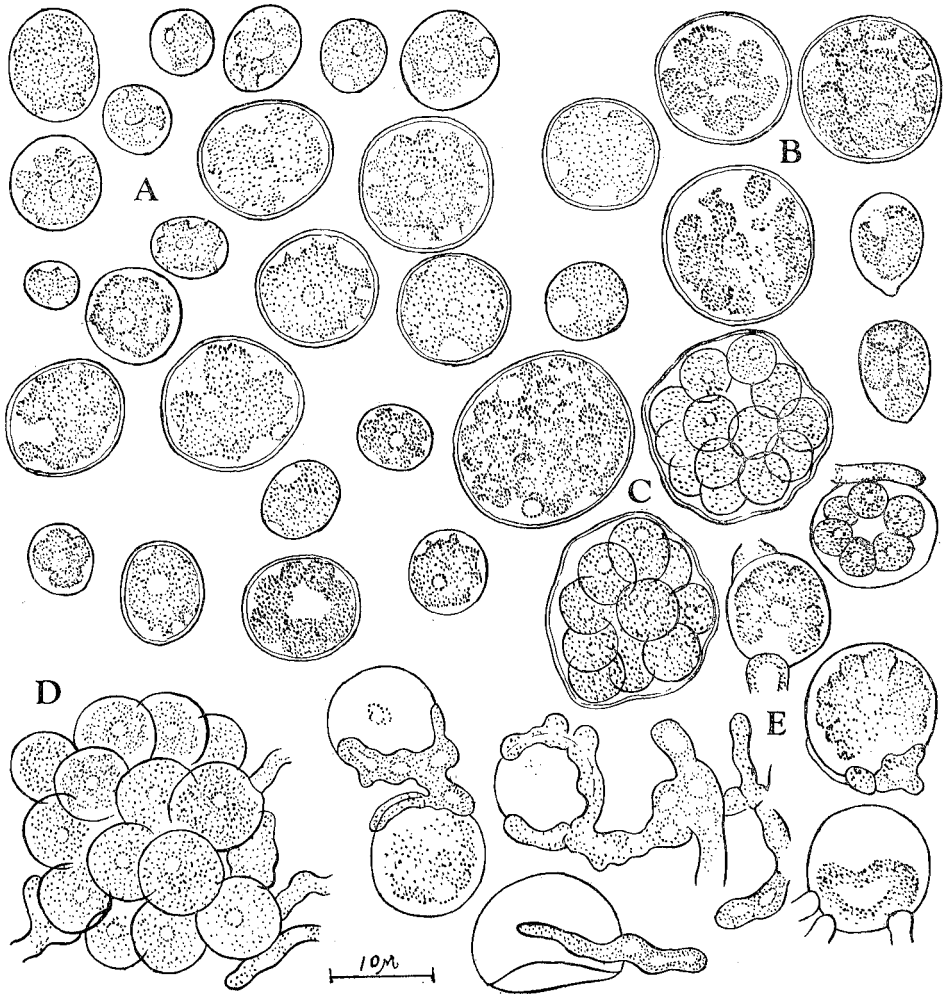


Fig. 3. *Trebouxia antarctica*, algal component of imperfect lichen. A: Vegetative cells. B: Abnormal cells looking like zoospore formation. C: Autospore formation. D: Group of autospores attacked by hyphae. E: Various stages of attack by hyphae showing the gradual digestion of chromatophores.

room temperature, nothing was found to germinate. Although the culture of a bit of plant on malt agar medium was also practiced, the results were negative.

As for the multiplication of plant, the algal component seems to be able to

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reproduce asexually by zoospores and autospores, and fungal component by gemmae and blastospores respectively, although the soredial formation is also one of the reproductive means.

It is not always true that the fungal component is co-existing with algal component with mutual benefits. Various cases were observed to suppose that

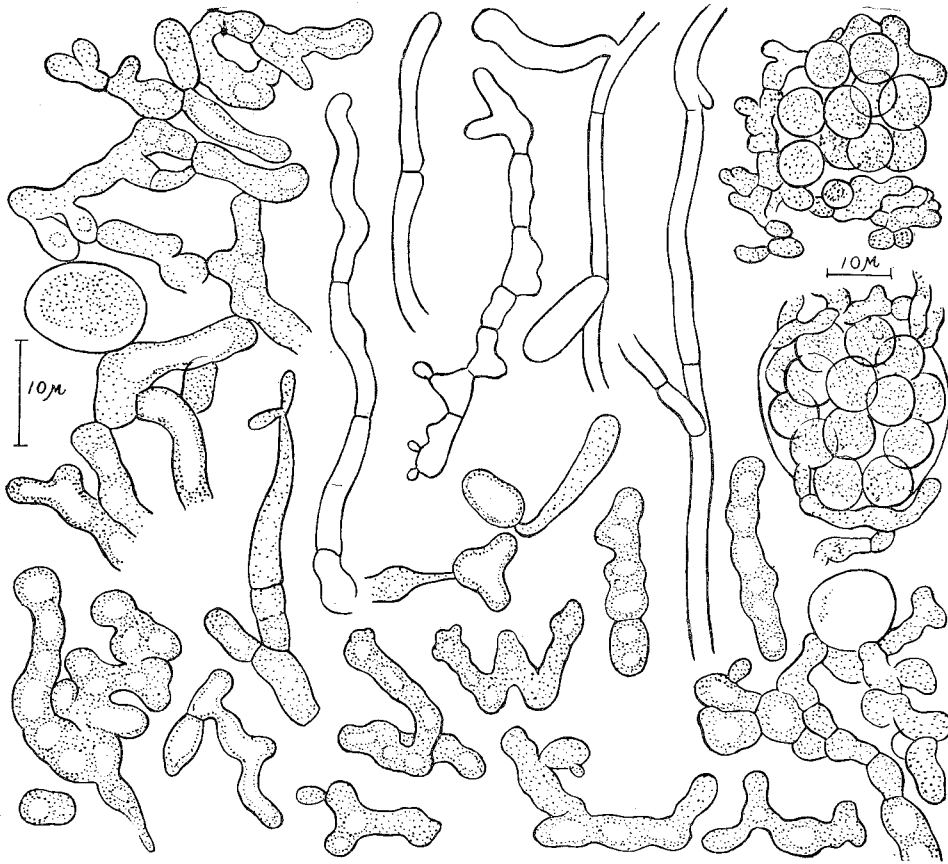


Fig. 4. Various forms of hyphae of fungal component.

the protoplasm and chromatophores of algal cells are attacked and digested by the fungal hyphae touching to them as illustrated in Fig. 3 E. It seems to be reasonable that in such an Antarctic region where the organic matters for nourishment are very scarce, the heterotrophic fungi can hardly live without preying upon these lower algae.

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